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10/034,122	01/03/2002	Mitsuhiko Kadono	011452	8413

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EXAMINER	
PROCTOR, JASON SCOTT	

ART UNIT	PAPER NUMBER
2123	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/034,122	Applicant(s) KADONO, MITSUHIKO
	Examiner Jason Proctor	Art Unit 2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *4-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *4-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claims 4-6 were rejected in Office Action dated 27 December 2005. Applicants' response dated 26 April 2006 has amended claim 4 and presented new claims 7-9. Claims 4-9 are pending in this application.

Claims 4-9 are rejected.

Claim Rejections - 35 USC § 102

In response to the previous rejections of claims 4-5 under 35 U.S.C. § 102 as being anticipated by US Patent No. 5,317,519 to Maeda, Applicants submit that Maeda does not anticipate the claims as amended. The Examiner has fully considered this argument and has found it persuasive. These rejections have therefore been withdrawn.

Claim Rejections – 35 USC § 103

The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 4-5 and 7-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 5,317,519 to Maeda in view of "Accelerated splatting using a 3D adjacency data structure" by Jeff Orchard and Torsten Möller (hereafter referred to as Orchard).

Regarding claims 4 and 7, Maeda discloses a method for generating post-machining three-dimensional shape data indicative of shape of workpiece to be obtained after machining on the basis of an NC program [*"a machining simulation system for displaying a situation where a tool works a material as an animation picture"* (column 2, lines 23-36)] including tool traveling path for a tool , tool shape data indicative a shape of the tool [*"three-dimensional pattern memory 21* [...] *for storing a shape of a tool"* (column 8, lines 53-58)] and stock blank shape data indicative of a shape of a stock blank for the workpiece to be machined with the tool in an NC machine tool [*"three-dimensional shape memory 11"* (column 4, lines 18-29); and the "shape" representing the blank workpiece to be machined with the tool (column 9, lines 47-54)], the method comprising the steps of:

representing the shape of the stock blank for the workpiece three-dimensional lattice point data comprising arranged along three axes extending perpendicularly to each other on the basis of the stock blank shape data, the multiplicity of lattice points being each defined by three-dimensional coordinate data [*"A three-dimensional shape memory 11 is a memory for storing a material shape, and its structure is illustrated in FIG. 3"* *"FIG. 4 shows one example of the material shape expressed by the three-dimensional*

shape memory 11. The material shape is expressed in the form of blocks [lattice points]. *"* (column 4, lines 18-29)];

generating data indicative of a tool traveling region in which the tool is to move with respect to the workpiece on the basis of the NC program, the tool shape data and the stock blank shape data [*"a machining simulation system for displaying a situation where a tool works a material as an animation picture"* (column 2, lines 23-36); *"In the actual machining simulation, when specifying the cutting feed, the operation is executed in the operation mode to change the material shape.* [...] *An NC program check can thus be effectively performed."* (column 10, lines 56-61)], then removing lattice points of the three-dimensional lattice point data located in the tool traveling region, and updating connection information for the remaining lattice points [*"when the tool shape is intruded in the material shape, reading the tool shape Z-value into the material shape"* (column 9, lines 47-53)]; and

generating the post-machining three-dimensional shape data for the workpiece on the basis of three-dimensional coordinate data and the connection information for the remaining lattice points [*"when the tool shape is intruded in the material shape, reading the tool shape Z-value into the material shape"* (column 9, lines 47-53); The tool shape memory subsequently represents the post-machining three-dimensional shape data and the connection information for the remaining lattice points].

Maeda discloses a computer implemented method (FIG. 2A) and therefore an apparatus for performing the method.

Maeda does not expressly disclose "connection information indicative of whether or not lattice points are present at positions adjacent to a lattice point of interest along the

three axes in the six axial directions, wherein the three-dimensional coordinate data used to define one lattice point are not connection information used to define another lattice point."

Orchard discloses a new acceleration for a volume rendering algorithm (abstract) comprising an "Adjacency Data Structure" (section 3).

Orchard discloses "connection information indicative of whether or not lattice points are present at positions adjacent to a lattice point of interest along the three axes in the six axial directions, wherein the three-dimensional coordinate data used to define one lattice point are not connection information used to define another lattice point" [*"...we will define two voxels as 'adjacent' if they are in the same scan line and have no visible voxels between them. A structure containing 6 indices is associated with each voxel. It keeps the index of the next visible voxel in each direction along each principal axis. We will call this structure an 'adjacency structure'."* (section 3.1, first paragraph)].

Orchard discloses "connection information including six connection signs indicative of whether or not lattice points are present at positions adjacent to a lattice point of interest along the three axes in the six axial directions [*"...we will define two voxels as 'adjacent' if they are in the same scan line and have no visible voxels between them. A structure containing 6 indices is associated with each voxel. It keeps the index of the next visible voxel in each direction along each principal axis. We will call this structure an 'adjacency structure'."* (section 3.1, first paragraph)].

Maeda and Orchard are analogous art because both are directed to the problem of representing or rendering three-dimensional objects in a computer system.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the acceleration disclosed by Orchard in the machining simulation system of Maeda by incorporating that acceleration in the data processing and graphics rendering features of the machining simulation system.

The motivation for doing so would have been to achieve an algorithm that is *"robust and flexible, allowing for depth sorting of the data, including correct back-tofront ordering for perspective projections. This makes interactive splatting possible for applications [...] that rely on structure and depth information"* (Orchard, abstract) and *"rendering speed and encoding compression"* (Orchard, section 3, paragraph 2).

Therefore it would have been obvious to combine Orchard with Maeda to obtain the invention as specified in claims 4 and 7.

Regarding claims 5 and 8, Maeda discloses a three-dimensional shape data generating method and apparatus as set forth in claims 4 and 7, further comprising the step of:

extracting surface lattice points defining surfaces of the workpiece to be obtained after the machining on the basis of the connection information for the remaining lattice points after the update of the connection information for the remaining lattice points, wherein the post-machining three-dimensional shape data for the workpiece is generated on the basis of three-dimensional coordinate data and connection information for the surface lattice points [*"when the tool shape is intruded in the material shape, reading the tool shape Z-value into the material shape"* (column 9, lines 47-53); The tool shape memory subsequently represents the post-machining three-dimensional shape data and

the connection information for the remaining lattice points. The surface lattice points are extracted where the tool shape (ex. FIG. 20A-C) intersect the blocks (lattice points) of the shape material (ex. FIG. 4). By setting the Z-value of the tool at that intersection as the Z-value of the blocks (lattice points), the surface lattice points defining the surfaces of the finished workpiece are extracted].

2. Claims 6 and 9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Maeda in view of Orchard as applied to claims 4-5 and 7-8 above, and further in view of "Decimation of Triangle Meshes" by William J. Schroeder, Jonathan A. Zarge, and William E. Lorensen (Schroeder), and further in view of "Geometric and Solid Modeling: An Introduction" by Christoph M. Hoffmann (Hoffmann).

Regarding claims 6 and 9, Maeda in view of Orchard disclose the limitations of claims 4-5 and 7-8 as set forth above.

Neither Maeda nor Orchard does not expressly disclose the step of combining adjacent squares as recited by claims 6 and 9.

Schroeder teaches that it is known in the art to simplify polygonal meshes to reduce model size, thereby speeding up rendering speeds (page 65, left column). Schroeder achieves this by making *"multiple passes" "over all vertices in the mesh. During a pass, each vertex is a candidate for removal and, if it meets the specified decimation criteria, the vertex and all triangles that use the vertex are deleted* [which combines adjacent faces]. " (page 66, left column).

Schroeder and Maeda in view of Orchard are analogous art because all are drawn to rendering three-dimensional objects in a computer system.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to combine the teachings of Schroeder regarding the simplification of polygonal meshes, such as the lattice points defining surfaces shown by Maeda in FIG. 4, with the invention of Maeda in view of Orchard, to improve rendering speeds when displaying the finished workpiece.

The motivation to do so would have been to *"significantly reduce the number of triangles required to model an object to a given level of detail"* (Schroeder, page 68, Section 6).

Therefore, it would have been obvious to combine Schroeder with Maeda in view of Orchard.

However, Schroeder is directed toward triangular polygons.

Hoffmann teaches a method of finding intersecting faces in computer graphs ("Face/Face Intersection", page 87). The degenerate case, when two faces are in the same plane, Hoffmann teaches computation of the face normals [*"setting normal vectors on the respective squares* [faces]*"*]. Hoffmann teaches that normals of equal direction mean the area is intersecting [*"adjacent squares having parallel normal vectors"*]. Thus Hoffmann teaches that coplanar intersecting faces [*"adjacent squares having parallel normal vectors"*] can be identified by comparing their face normals.

Hoffmann, Schroeder, and Maeda in view of Orchard are analogous art because all are drawn to rendering three-dimensional objects in a computer system.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to combine the teachings of Hoffman with Maeda in view of Orchard and further in view of Schroeder, to simplify the polygonal mesh defined by the lattice points of Maeda's finished workpiece. The surfaces defined by a polygonal mesh of lattice points are orthogonal, thus a person of ordinary skill in the art would recognize "adjacent coplanar faces" as the obvious choice for a "decimation criteria" (taught by Schroeder, page 66, right column) in a lattice point model. Indeed, Schroeder's explicitly teaching of a "decimation criteria" seeks to minimize distance from the average plane (page 66, right column); in the case of lattice point data, using "adjacent coplanar faces" as the "decimation criteria" ensures that the distance from the average plane is always zero. Thus a person of ordinary skill in the art, motivated by Schroeder to combine faces in the model, would have found it obvious to identify adjacent coplanar faces in the lattice point model and to combine those faces to simplify the model and increase rendering speed of the model.

The motivation for doing so would have been to ensure correctness of the technique by using methods taught in a textbook.

Therefore it would have been obvious to combine Hoffman with Maeda in view of Orchard and further in view of Schroeder.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Proctor whose telephone number is (571) 272-3713. The examiner can normally be reached on 8:30 am-4:30 pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason Proctor
Examiner
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6/30/06